What is claimed is

1. A method for analyzing a semiconductor manufacturing process, comprising:

(a) generating sets of input and output data from the semiconductor manufacturing process;

(b) determining principal components from the set of input data by Principal Component Analysis (PCA) and a set of principal component score data based on the principal components; and

(c) determining a relationship between the sets of input and output data from the set of principal component score data and the set of output data.

2. The method of claim 1, further comprising feeding back the relationship to the semiconductor process to predict sets of new input and output data.

3. The method of claim 1, wherein the step (a) comprises generating the input and output data from a thermal diffusion process.

4. The method of claim 3, further comprising performing the thermal diffusion process in a vertical furnace.

5. The method of claim 4, wherein the set of input data comprise different zone temperatures in the vertical furnace.

6. The method of claim 4, wherein the set of output data comprise thicknesses of a thin film layer formed by the thermal diffusion process.

7. The method of claim 1, further comprising transforming the sets of input and output data into sets of transformed input and output data by a model.

8. The method of claim 7, further comprising comparing the sets of input and output data with the sets of transformed input and output data.

9. The method of claim 7, wherein the model is an Arrhenius model.

10. The method of claim 1, wherein the step (c) comprises applying a regression model to determine the relationship.

11. The method of claim 10, wherein the regression model comprises a linear regression model.

12. The method of claim 1, further comprising applying design of experiment (DOE) to generate the set of input and output data.

13. A method for analyzing a thermal diffusion process in a vertical furnace, comprising:

(a) generating sets of input and output data from the thermal diffusion process by DOE;

(b) determining principal components from the sets of input data by Principal Component Analysis (PCA) and a set of principal component score data based on the principal components; and

(c) determining a relationship between the sets of input and output data from the set of principal component score data and the set of output data.

14. The method of claim 13, further comprising feeding back the relationship to the semiconductor process for predicting sets of new input and output data.

15. The method of claim 13, wherein the set of input data comprise different zone temperatures in the vertical furnace.

16. The method of claim 13, wherein the set of output data comprise thicknesses of a thin film layer formed by the thermal diffusion process.

17. The method of claim 13, further comprising transforming the sets of input and output data into sets of transformed input and output data by a model.

18. The method of claim 17, further comprising comparing the sets of input and output data with the sets of transformed input and output data.

19. The method of claim 17, wherein the model is an Arrhenius model.

20. The method of claim 13, wherein the set of principal component score data comprise principal component scores.

21. The method of claim 13, wherein the step (c) comprises applying a regression model to determine the relationship.

22. The method of claim 21, wherein the regression model comprises a linear regression model.

23. A method for analyzing a thermal diffusion process in a vertical furnace, comprising:

(a) generating a set of input data having different zone temperatures in the vertical furnace and a set of output data having thicknesses of a thin film layer by DOE;

(b) transforming the sets of input and output data into sets of transformed input and output data by an Arrhenius model;

(c) comparing the sets of input and output data with the sets of transformed input and output data;

(d) determining principal components from the sets of input data by Principal Component Analysis (PCA) and a set of principal component scores based on the principal components;

(e) determining a relationship between the sets of input and output data from the set of principal component scores and the set of output data by a linear regression model; and

(f) feeding back the relationship to the semiconductor process to predict sets of new input and output data.

24. A system for analyzing a thermal diffusion process in a vertical furnace, comprising, comprising:

at least one storing means adapted to store sets of input data and output data from the semiconductor manufacturing process; and

at least one processor coupled to the storing means, adapted to determine principal components from the sets of input data by Component Analysis (PCA) and a set of principal score data based on the principal components, and determine a relationship between the sets of input and output data from the set of principal component score data and the set of output data.

25. The system of claim 24, wherein the processor further is adapted to feed back the relationship to the storing means, and predicts sets of new input and output data.

26. The system of claim 24, wherein the set of input data comprise different zone temperatures in the vertical furnace.

27. The system of claim 24, wherein the set of output data comprise thicknesses of a dielectric layer formed by the thermal diffusion process.

28. The system of claim 24, wherein the processor further is adapted to transform the sets of input and output data into sets of transformed input and output data by a model.

29. The system of claim 28, wherein the processor further is adapted to compare the sets of input and output data with the sets of transformed input and output data.

30. The system of claim 28, wherein the model is an Arrhenius model.

31. The system of claim 24, wherein the processor is adapted to determine the relationship by using a regression model.

32. The system of claim 31, wherein the regression model comprises a linear regression model.

33. The system of claim 24, where the sets of input and output data are generated by design of experiment (DOE).